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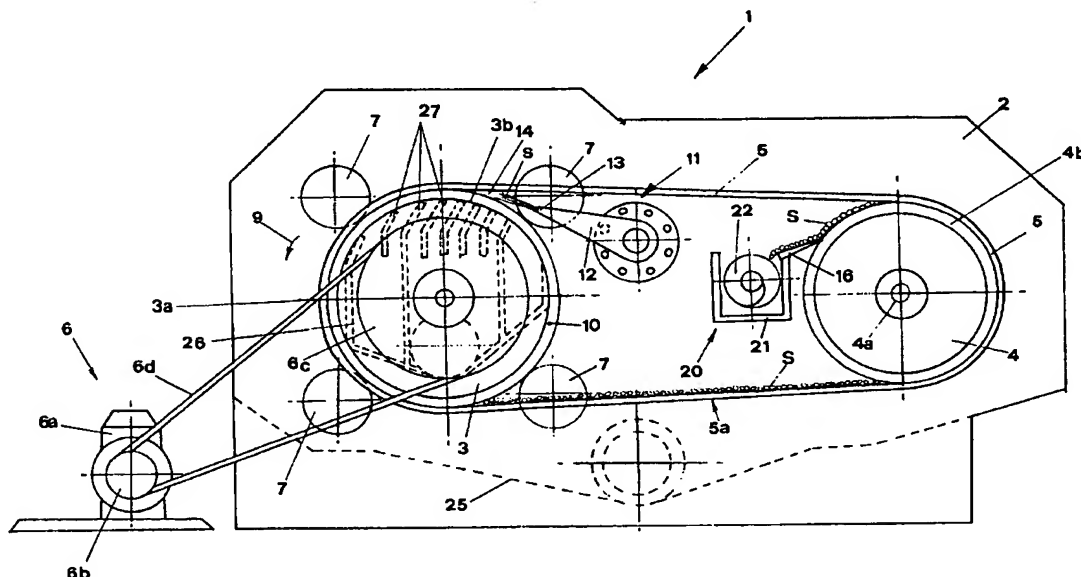
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(54) Title: WASHING MACHINE FOR CELLULOSE FIBERS



(57) Abstract: A washing machine (1) for a suspension (S) of cellulose fibers in a liquid is disclosed comprising: a couple of drums (3, 4) between which a closed loop of a flexible wire (5) provided with microholes is wound; conveyance means (11) of the suspension (S) arranged at the starting zone (14) of contact between the flexible wire (5) and a first drum (3); collection means (25, 26) of the liquid containing the contraries coming from the washing operation of the suspension (S); collection means (20) of the washed fibers arranged at a second drum (4), wherein the lateral surface (3b) of the first drum (3) is provided with through microholes.

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WASHING MACHINE FOR CELLULOSE FIBERS

The present invention relates to a washing machine for cellulose fibers used in papermaking industry.

It is well known that different stocks of cellulose fibers are used for making paper, whose chemical, physical and mechanical features must be carefully selected because they are decisive to define the quality of the paper being made.

A first selection of the cellulose fibers consists in separating the polluting particles contained in the stock that are particularly relevant when the starting material is for instance waste paper.

Such a separation is obtained by a washing operation carried out by special machines called washers, generally comprising a couple of drums, at least one of said drums being powered, a closed loop of wire provided with gauged holes being wound around the drums.

The couple of drums comprises a grooved drum having a plurality of circumferential parallel grooves and a smooth drum provided with a doctor board under which there is a recovery container for the washed cellulose fibers.

At start of the washing operation the cellulose fibers are dispersed in a water based solution with a maximum concentration of 1% contained in a tank.

This tank communicates with a headbox whose slice is arranged parallel to the axis of the drums inside the closed loop of the perforated wire and facing the zone where the perforated wire begins to be wound on the grooved drum.

The solution of cellulose fibers coming out from the headbox penetrates between wire and grooved drum and rotates together with drum adhering thereto for the wire winding length.

In this operative stage the solution in view of the centrifugal force induced by the drum rotation, releases water and contraries of small size passing through the gauged holes of the wire and collected outside the machine.

Therefore the suspension loses water and contained contraries not by squeezing but by centrifugal force induced thereon by the drum rotation, causing water and contraries to pass through the gauged holes of the wire.

Subsequently the cellulose fibers adhering to the wire are delivered to the smooth drum where they are pressed so as to remove therefrom a further quantity of water, now by squeezing.

At the end of the compression, when the wire leaves the smooth drum, the cellulose fibers result to be washed and adhere to the drum.

The fibers are then removed from the drum through a scraping band and is recovered inside a container where they fall by gravity.

5 A drawback of the above mentioned washers of known type consists in that the drums, in order to eject efficiently water and contraries contained in the suspension, are being rotated at high speed so that the high centrifugal force causes also the short cellulose fibers to pass through the holes of the wire and are therefore removed together with contraries.

10 This is a particularly relevant problem when suspensions comprising waste paper are being treated, in which the percentage of short fibers is very high.

Another drawback consists in that during the washing operation the longer and heavier cellulose fibers in view of the centrifugal force are distributed on the drums close to the wire contact surface, so as to form a mesh preventing the
15 total ejection of water and contraries.

A last but not least drawback consists in that the above mentioned prior art machines washing considerable amounts of cellulose fibers in a short time, have big dimensions and therefore require much room.

The present invention aims at overcoming the above mentioned drawbacks.

20 A first object of the invention is to provide a washing machine for cellulose fibers in which the amount of short cellulose fibers ejected together with the contraries is considerably reduced.

Another object of the invention is to provide a machine that can eject a greater quantity of water and contraries in comparison with known machines of the
25 same size and output.

A further object is to drastically reduce the position of long fibers on the wire surface that in the conventional machines reduces ejection of water and contraries.

Said objects are attained with a washing machine for a suspension of cellulose
30 fibers in a liquid that according to the main claim comprises:

- at least a couple of drums between which a closed loop of a flexible wire provided with microholes is wound;
- means conveying said suspension to the starting zone of contact between said flexible wire and a first drum of said at least one couple of drums;
- 35 - means for collecting the liquid containing said contraries coming from the

washing operation of said suspension;

- means to collect the washed fibers arranged at a second drum of said at least one couple of drums,

and is characterized in that the lateral surface of said first drum is provided with through microholes.

According to a preferred embodiment that will be described hereinafter, the perforated surface of said first drum is covered by a filtering mat cooperating with the perforated flexible wire.

Release of water and contraries contained in the suspension, occurs by the combined action of the centrifugal force induced on the suspension by rotation of the first drum pushing contraries and water outside the drum and by the squeezing action produced by the mutual contact between mat and wire pushing contraries and water inside the drum.

A further water release occurs by the squeezing action produced by the wire and the second drum between which the washed suspension is contained.

As to the conveyance means for the suspension to be washed, they consist of a known headbox whose slice is facing the starting zone of contact between wire and the first drum.

The liquid and the contraries ejected from the cellulose suspension by the combined action of centrifugal force and squeezing action, are collected in containers, one being arranged inside the first drum and the other outside it.

The washed cellulose fibers left adhering to the wire are squeezed by the contact with the second drum, from which they are scraped and collected by gravity in a screw taking them away from the machine.

Advantageously the machine of the invention allows to eject water and polluting particles without ejecting the short cellulose fibers as well.

Indeed as the first drum is perforated, it discharges water and polluting particles both outside and inside, so that it is possible to obtain the same degree of suspension washing although the drum is rotating to a surface speed lower relative to drums of equivalent machine of the prior art.

Still advantageously the machine of the invention allows a uniform distribution of long fibers on the filtering surface, reducing their resistance to water ejection.

The above mentioned objects and advantages will be better understood from reading the description of the preferred embodiment of the invention which is

given as an illustrative and non limiting example with reference to the accompanying sheets of drawings in which:

- Fig. 1 is a side view of the machine of the invention;
- Fig. 2 is a top plan view of the machine of Fig. 1; and
- 5 - Fig. 3 is front view of the machine of Fig. 1.

As shown in Figs. 1 to 3, the washing machine for cellulose fibers of the invention generally indicated with reference numeral 1, comprises a frame 2 supporting a first drum 3 and a second drum 4 defining parallel and horizontal longitudinal axes X, Y respectively, on which a closed loop of flexible wire 5 provided with microholes is wound.

The first drum 3 as shown particularly in Fig. 3, has a central shaft 3a which is being rotated by driving means generally indicated with numeral 6. The drum is further supported at the opposite end relative to the central shaft 3a by four grooved rollers 7 belonging to a plane generally orthogonal to its longitudinal axis X and supporting the drum at a circular ring 8 belonging to said drum.

Said driving means 6 comprise a motor 6a coupled to a driving unit consisting of a first pulley 6b fixed to the motor 6, a second pulley 6c fixed to the central shaft 3a and a driving belt 6d wound between said pulleys.

The flexible wire 5 is moved counterclockwise as indicated by the arrow 9, being moved by friction on the first drum 3 and being wound on the second drum 4 which however is idle and is supported by a central shaft 4a.

On the first drum 3 a filtering mat 10 is also wound and is interposed between the surface of the first drum 3 and the flexible wire 5 contributing to the washing operation of the cellulose fibers as it will be explained below.

25 The machine comprises also conveyance means for the suspension of cellulose fibers to be washed, generally indicated with numeral 11, consisting of a headbox 12 whose slice 13 is facing the starting zone 14 of contact between the flexible wire 5 and the first drum 3. At second drum 4 there is at least a doctor board 16 which is in contact with the lateral surface 4b of the second drum 4 and is inclined to collection means for the washed fibers generally indicated with numeral 20.

These collection means as shown in greater detail also in fig. 2 comprise a container 21 arranged parallel to the axes X, Y of both drums 3, 4, inside which a screw 22 is rotating, extracting laterally the washed fibers along the direction Z shown in Fig. 2.

According to the invention the lateral surface 3b of the first drum 3 is provided with through microholes.

It has to be noted that in the machine there are collection means for the liquid containing the contraries arising from the washing operation of suspension S, comprising a first container 25 arranged outside and under both rotary drums 3, 4 and a second container 26 arranged inside the first filtering drum 3.

Inside the first drum 3 there are also scraping means 27 keeping clean its internal surface.

In operation during rotation of the first drum 3, the suspension of fibers S contained between the first drum 3 and the flexible wire 5 undergoes a centrifugation action.

Water and contraries contained therein are therefore ejected by centrifugal force outward through the microholes of the flexible wire 5.

Water and contraries coming out to the outside are collected in the first container 25 falling by gravity thereinto.

At the same time the suspension of fibers undergoes also a compression process to the filtering mat 10 through which further contraries also mixed with water are passing, falling by gravity inside the second container 26 arranged inside the first drum 3.

The washed cellulose fibers remain adhering to the inner wall of the lower run 5a of the flexible wire 5 conveying the fibers in contact with the lateral surface 4b of the second drum 4 where they undergo a further loss of water by compression between the second drum 4 and the flexible wire 5.

Then the cellulose fibers come to the upper part of the second drum 4 where they are contacted by the doctor board 16 removing them from the surface of the drum and causing the fibers to fall by gravity inside the collection means 20 where the screw 22 moves them laterally away from the machine.

By acting with the two filtering surfaces in mutual contact, that is filtering mat 23 in combination with the flexible wire 5 provided with microholes, the rotation speed of the first drum 3 may be decreased and consequently the quantity of short cellulose fibers being lost by centrifugal force can be drastically reduced. Moreover the deposition of long fibers preventing ejection of water and contraries is avoided as well.

From the foregoing one can see that the machine of the invention attains the intended objects.

The machine may obviously be carried out in any size and possible modifications not shown and not mentioned when falling within the scope of the appended claims, should be considered covered by the present patent.

CLAIMS

1) A washing machine (1) for a suspension (S) of cellulose fibers in a liquid comprising:

- at least a couple of drums (3, 4) between which a closed loop of a flexible wire (5) provided with microholes is wound;
- conveyance means (11) of said suspension (S) arranged at the starting zone (14) of contact between said flexible wire (5) and a first drum (3) of said at least a couple of drums;
- collection means (25, 26) of the liquid containing said contraries coming from the washing operation of said suspension (S);
- collection means (20) of the washed fibers arranged at a second drum (4) of said at least a couple of drums,

characterized in that the lateral surface (3b) of said first drum (3) is provided with through microholes.

2) The machine (1) according to claim 1) **characterized in that** said collection means of the liquid containing said contraries comprise a first container (25) arranged outside and under said drums (3, 4) and a second container (26) arranged inside said first drum (3).

3) The machine (1) according to claim 1) **characterized by** comprising also a filtering mat (10) wound on the outer lateral surface (3b) of said first drum (3).

4) The machine (1) according to claim 1) **characterized in that** said first drum (3) has a central shaft (3a) coupled to driving means (6) adapted to rotate the drum and supported at the opposite end by grooved rollers (7) all arranged on a plane generally orthogonal to said central shaft (3a), and supporting said first drum (3) at a circular ring (8) provided on said drum.

5) The machine (1) according to claim 4) **characterized in that** said driving means (6) comprise a motor (6a) coupled to a driving unit consisting of a first pulley (6b) fixed to said motor (6), a second pulley (6c) fixed to said central shaft (3a) and a driving belt (6d) wound between said pulleys.

6) The machine (1) according to claim 1) **characterized by** comprising at least a doctor board (16) arranged in contact with the lateral surface (4b) of said second drum (4) and inclined to said collection means (20).

7) The machine (1) according to claim 1) or 6) **characterized in that** said collection means (20) comprise a container (21) arranged parallel to said

drums (3, 4), a screw (22) being arranged inside said container.

8) The machine (1) according to claim 1) **characterized in that** said conveyance means (11) of said suspension (S) consist of a headbox (12).

9) The machine (1) according to claim 1) **characterized in that** said first
5 drum (3) is provided inside with scraping means (27) arranged in contact with its inner surface.

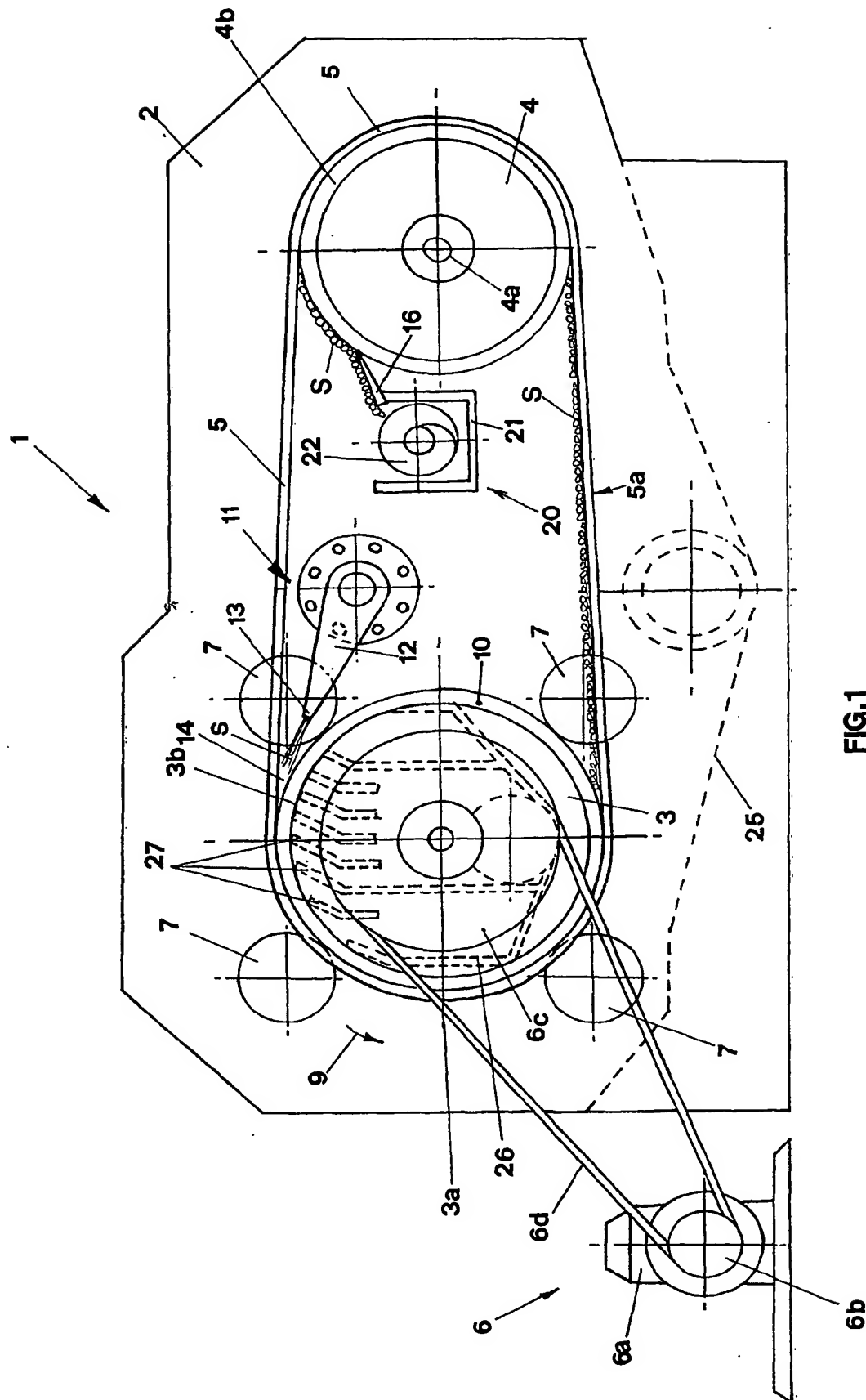
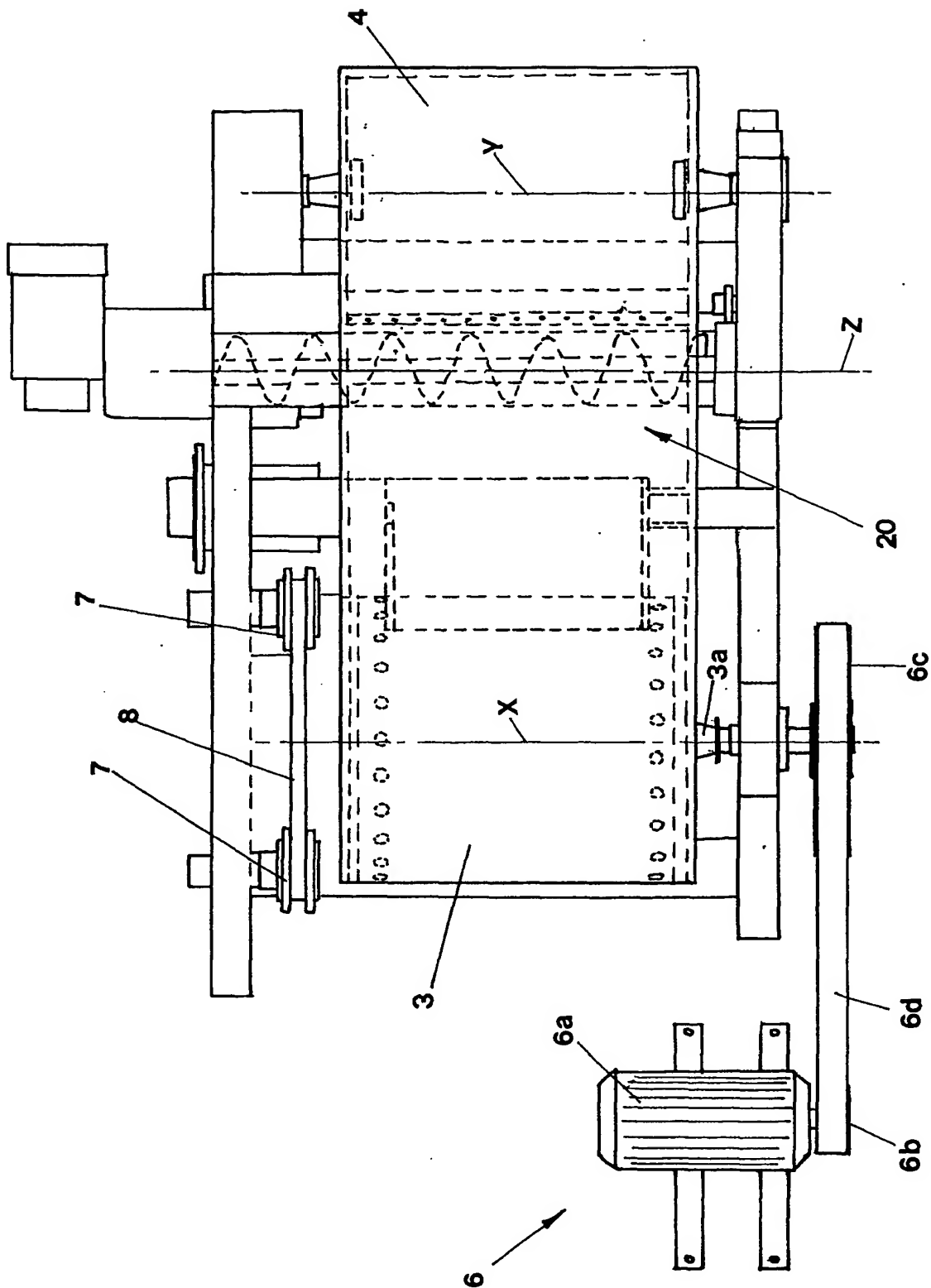


FIG.1



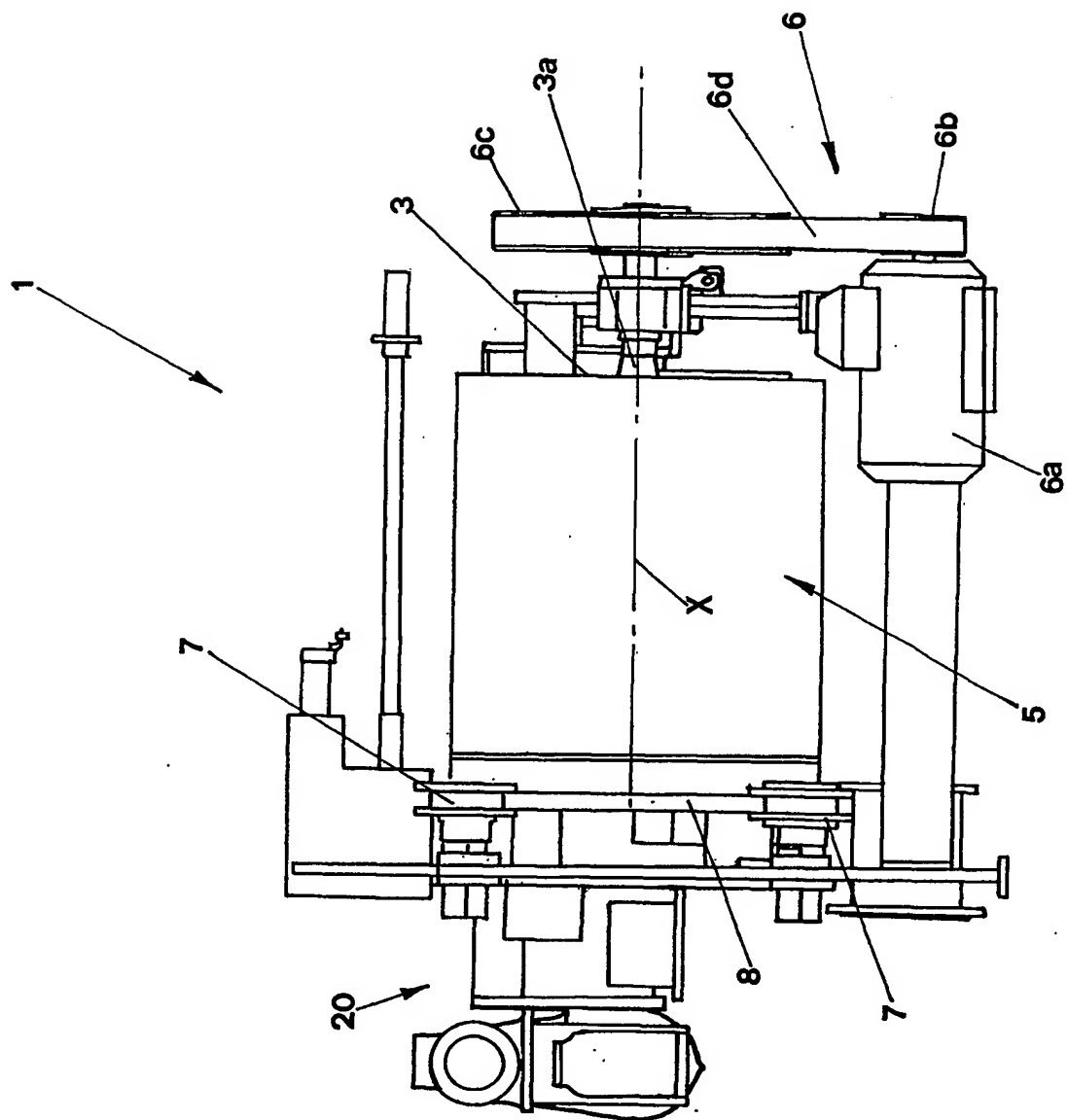


FIG. 3